

WHO INFORMATION SERIES ON SCHOOL HEALTH

DOCUMENT ONE

Strengthening
Interventions
to Reduce
Helminth
Infections

As an Entry Point
for the Development
of Health-Promoting
Schools



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World Health Organization
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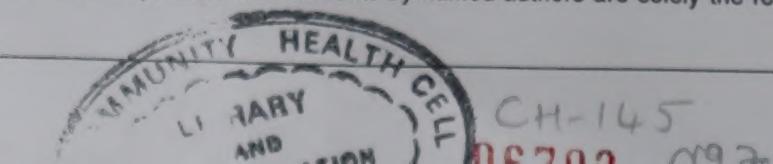
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FOREWORD

Investments in schools are intended to yield benefits to communities, nations and individuals. Such benefits include improved social and economic development, increased productivity and enhanced quality of life. In many parts of the world, such investments are not achieving their full potential, despite increased enrolments and hard work by committed teachers and administrators. This document describes how educational investments can be enhanced, by increasing the capacity of schools to promote health *as they do learning*.

For better or worse, health influences education. Healthy children learn well. If children are healthy, they can take full advantage of every opportunity to learn. But, children who cannot attend school because of poor health or unhealthy conditions cannot seize the opportunities that schools provide. Similarly, schools cannot achieve their full potential if children who attend school are not capable of learning well. Poor health and unhealthy conditions jeopardize the value of school attendance.

This document is the first of a technical series on school health promotion prepared for WHO's Global School Health Initiative. It is appropriately the first, because helminth infections are the world's leading cause of diseases among school-age children.

WHO's Global School Health Initiative is a concerted effort by international organizations to help schools improve the health of students, staff, parents and community members. Education and health agencies are encouraged to use this document to strengthen helminth interventions as part of the Global School Health Initiatives goal: to help all schools become "health promoting" schools.

Although definitions will vary, depending on need and circumstance, a "health promoting" school can be characterized as *a school constantly strengthening its capacity as a healthy setting for living, learning and working* (see box).

The extent to which each nation's schools become health promoting schools will play a significant role in determining whether the next generation is educated and healthy. Education and health support and enhance each other. Neither is possible alone.

Dr Ilona Kickbusch, Director
Division of Health Promotion, Education and
Communication, WHO



HEALTH PROMOTING SCHOOL

A "health promoting" school:

- ◆ fosters health and learning with all the measures at its disposal.
- ◆ engages health and education officials, teachers, students, parents, and community leaders in efforts to promote health.
- ◆ strives to provide a healthy environment, school health education, and school health services along with school/ community projects and outreach, health promotion programmes for staff, nutrition and food safety programmes, opportunities for physical education and recreation, and programmes for counselling, social support and mental health promotion.
- ◆ implements policies, practices and other measures that respect an individual's self-esteem, provide multiple opportunities for success, and acknowledge good efforts and intentions as well as personal achievements.
- ◆ strives to improve the health of school personnel, families and community members as well as students; and works with community leaders to help them understand how the community contributes to health and education.



WHO INFORMATION SERIES ON SCHOOL HEALTH

STRENGTHENING INTERVENTIONS TO REDUCE HELMINTH INFECTIONS THROUGH SCHOOLS

This document is intended to help people use Health Promotion strategies to improve health. It is based on the recommendations of the Ottawa Charter for Health Promotion (1986). It will help individuals and groups move towards a new approach to public health, one that creates on-going conditions conducive to health, as well as reductions in prevailing health problems.

1. INTRODUCTION

1.1 Why did WHO prepare this document?

The World Health Organization (WHO) has prepared this document to help people take control over and to improve their health. It provides information that will help people implement interventions that will reduce helminth infections through schools often by relatively low-cost measures.

1.2 Who should read this document?

This document should be read by:

- (a) Policy- and decision-makers, programme planners and coordinators at local, district (provincial) and national levels.
- (b) Officials and institutions responsible for planning and implementing the interventions described in this document, especially those from the ministries of health and education.
- (c) Programme staff and consultants of international health, education and development programmes which are interested in promoting health through schools.
- (d) Community leaders, school personnel, health workers, service providers and members of organized groups, e.g., women's groups, interested in improving health, education and well-being in the school and community.

1.3 What is a helminth infection?

The term "helminth" is often used to refer to a variety of worms that live as parasites in the human body. A helminth infection occurs when worms (or eggs) enter, mature, lay eggs and feed off a person. The names of the important helminths, where they live in the human body and their geographical distribution are presented in Annex I.

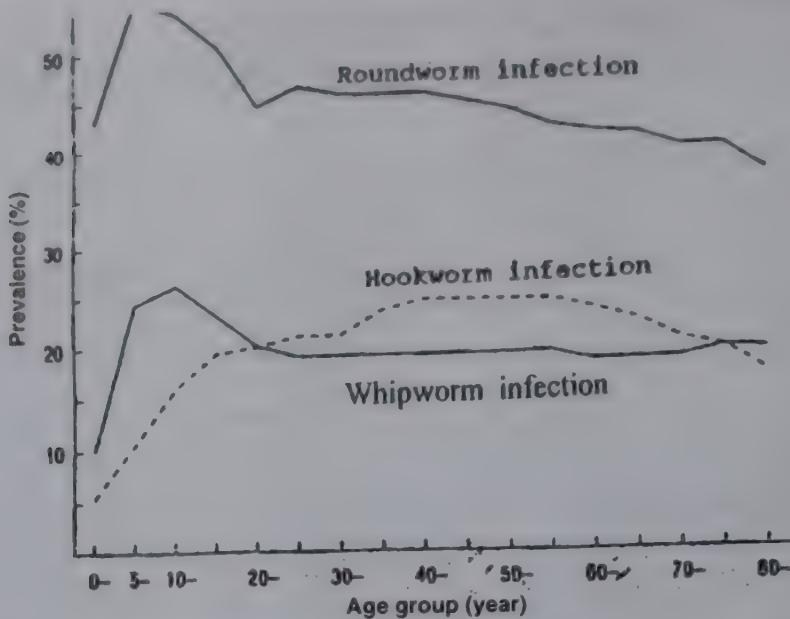
1.4 Why reduce helminth infections?

Helminth infections are one of the leading causes of diseases among young people and adults in the world today. They affect the health and well-being of millions of people, especially young people. The figure on the next page shows an example that the highest rates of roundworm and whipworm infections are often demonstrated in the groups of 5-9 and 10-14 years old (cited from the Bulletin of the World Health Organization, 1995, 73:510).

1.5 Why focus efforts through schools?

In countries where helminth infections prevail, schools provide the most effective and efficient way to reach large portions of the population, including young people,





school personnel, family and community members; and to reduce infections and prevent re-infections. School children are often the group that has the highest infection rate as well as the highest worm burden which contribute greatly to the contamination of the environment. These efforts may be most effective when integrated into more comprehensive approaches to school health, such as in the development of "health promoting schools".

1.6 How will this document help people to take control over and to improve health?

This document is based on the latest scientific research and control experience related to helminth infection, but it is more than a technical document. It is designed to help people address the broad range of factors that must be changed to reduce helminth infections, to prevent re-infections and to improve health through schools. It will help you and others to:

- Create Healthy Public Policy:** This document provides information that you can use to argue for increased local, district and national support for helminth reduction and school health efforts. It also provides a basis for justifying the decisions to increase such support.
- Develop Supportive Environments:** This document describes the environmental changes that are required to reduce helminth infections and how those changes can be made at the lowest possible costs.
- Reorient Health Services:** This document describes how current health services can be changed to seize the new opportunities afforded by schools resulting from the development of safer medications and more effective school health promotion programmes.
- Develop Personnel Skills:** This document identifies the skills that young people need to avoid helminth infection. It also identifies skills needed by others to create conditions conducive to helminth reduction and health through the school.
- Mobilize Community Action:** This document identifies essential actions that must be taken by the school and community together to reduce and prevent helminth infections; identifies ways in which the school can help to mobilize the community to implement such actions and to strengthen school health programmes. It also provides arguments and facts that can be communicated through the mass media to call attention to the problem of helminth infections.



This section provides information that one can use to convince others of the importance of reducing helminth infections, especially through schools. It also contains arguments to help policy- and decision-makers justify their decisions to increase such support.

The following arguments strongly support the importance of helminth reduction interventions as part of a school health programme and the need for increased investment in such programmes.

2.1 Argument: Helminth infections destroy the well-being and learning potential of millions of children in countries struggling to help their people develop better lives!

Although the majority of the children in developing countries now survive beyond their fifth birthday, they still face major problems of ill-health and malnutrition. One of the major health problems faced by hundreds of millions of school-age children is infection by roundworm, whipworm, hookworm, schistosome and other flukes, and/or guinea worm. These parasites consume nutrients from the children they infect. In doing so, they bring about or aggravate malnutrition and retard children's physical development. They also destroy the tissues and organs in which they live; and cause abdominal pain, diarrhoea, intestinal obstruction, anaemia, ulcers, and various health problems. All of these consequences of infection compromise children's attendance and performance at school. And, not uncommonly, heavy or long-term infection can result in death, if treatment is not given in time. Thus, as the number one cause of diseases among 5-14 year-old children, helminth infection should be one of the first problems addressed to enhance the quality of life, health and productivity of children throughout the world.

2.2 Argument: Intestinal helminths are stunting the growth and development of millions children in countries which must count on their development to achieve progress!

Roundworm, whipworm and hookworm are helminths that infect about 400 million school-age children throughout the world. In fact, roundworm and whipworm alone are estimated to affect one quarter of the world's population. Their eggs or young worms are found in the soil. People become infected by coming into contact with soil or vegetables that contain these eggs or young worms. Roundworm, whipworm and hookworm infections each affect the health and well-being of infected populations differently:

- Roundworm infections can retard growth. They decrease the absorption of nutrients that the body needs to grow. They cause structural problems in the small intestine in children. They are thought to be a cause of frequent or serious pulmonary disease among children. Intestinal obstructions frequently result in the hospitalization of children. Death is not uncommon in children when worms move to organs outside of the intestines such as the trachea, liver, and heart, and when complications occur.
- Whipworm infections are associated with high incidence of dysentery, chronic colitis, anaemia and growth retardation, where intense infections are reported.
- Hookworm infections cause iron deficiency anaemia and even minor infections may result in severe anaemia in children and in adolescent girls.

2.

**CONVINCING OTHERS
THAT HELMINTH
REDUCTION
INTERVENTIONS
IN SCHOOLS
IS IMPORTANT**



These infections also contribute to poor appetite and decreased food intake. Each can contribute to malnutrition, anaemia or other states of poor health, which in turn, can lead to an impairment of learning and poor school performance. It is important to note that the stunting of children's growth is not readily recognized, because it occurs almost imperceptibly over time. Thus, the full impact of helminth infections is greatly under-reported.

2.3 Argument: Schistosomiasis infects millions of young people, then causes chronic diseases in their productive years of life!

Over 200 million persons are infected by schistosome, the parasite that causes schistosomiasis. Of those infected, approximately 88 million are under 15 years of age. Schistosome infection is acquired by contact with freshwater that contains the young parasites. Schistosomiasis, usually a chronic disease observed in adults, is often a consequence of the heavy infections acquired in childhood.

The highest rate and the heaviest worm load of urinary schistosomiasis in African countries occur among children of 10-14 years old. Bloody urine may be visible in 10-20% of infected children. Most of the persons heavily infected by intestinal schistosomiasis in Africa and South America are between 10 and 14 years of age.

There is a relationship between heavy schistosome infections (infections that involve very large numbers of the parasites) and chronic schistosomiasis in children. Schistosomiasis has a detrimental effect on the growth and development of school-age children, especially in association with anaemia, malnutrition and stunting of growth. In Asia, dwarfism due to schistosome infection is not uncommon in areas reporting a large number of cases of a certain type of schistosomiasis.

2.4 Argument: Food-borne trematode infection due to consuming certain raw foods affects children's liver, lungs and intestines!

Globally, some 40 million persons are infected with trematodes, i.e., flukes, which affect the liver, lungs and intestinal tract. Of these infections, approximately 15 million are among children.

People contract fluke infections by ingesting raw or inadequately cooked fish, shellfish or aquatic vegetables that contain the larvae of the fluke. Widely distributed in the world, these infections have a considerable impact on health of children and adults. The impact of these diseases on children is not well documented, but high infection rates and even deaths due to heavy fluke infections in children are reported in many countries.

2.5 Argument: Guinea worm disease is a risk to millions of people who are without safe water!

Guinea worm disease (dracunculiasis) is acquired only by drinking water containing tiny but visible organisms which have been infected by the parasite. The disease occurs among populations without access to safe sources of drinking water, particularly where people have to enter the source (e.g. stepwells or shallow ponds) to fetch water.

The infection usually causes blisters and ulcer on the lower leg or foot of the victim and leads to serious adverse effects on health, agricultural production, and school at-



tendance. Since the World Health Assembly adopted a resolution calling for the eradication of this disease in 1986, major progress has been made in reducing this disease. However, in Africa and south Asia, over 100 million people are living in areas where they still could be infected. School children are among the groups at risk.

This section provides information that you can use to convince others that helminth reduction interventions will really work, especially when implemented in schools. It also contains arguments to help policy- and decision-makers justify their decisions to implement such efforts.

The following arguments strongly support the efficacy of helminth reduction programme in schools.

3.1 Argument: We know how to prevent and reduce helminth infections in ways which in many cases are cost-effective!

All the above health problems and consequences can be prevented or greatly reduced through cost-effective interventions. In many countries, the school plays a major role in making these interventions available to the people who need and will benefit from them.

The basic interventions for reducing helminth infections are three: drug treatment, sanitary improvement, and health education. The advances in drug development during the last two decades have made mass treatment acceptable and affordable. However, for achieving sustainable results, drug treatment should be provided in combination with sanitary improvements and health education.

3.1.1 Drugs are safe, effective and easy to use!

The available drugs are highly effective in treating intestinal helminth, schistosome and other fluke infections. The single oral dose administration and the safety of the drugs allow them to be delivered outside of the medical setting. Therefore, a strategy of mass treatment could be targeted to school-age children through school settings.

3.1.2 Simplified diagnostic methods are available!

Qualitative and quantitative diagnostic methods for helminth infections are available for both individual and mass examinations without a need for sophisticated facilities.

3.1.3 These infections can be prevented!

The above-mentioned helminth infections are all preventable. An essential barrier to most helminths is to prevent human faeces from polluting the ground or surface water. The infections of the major intestinal helminths can be prevented through avoiding ingestion of, or contact with the contaminated soil. To avoid entering the infested water greatly reduces schistosomiasis. Food safety measures help prevent fluke infec-

3.

CONVINCING
OTHERS
THAT HELMINTH
REDUCTION
INTERVENTIONS
IN SCHOOLS WILL
REALLY WORK



tions which are transmitted by meat or vegetables. Provision of safe water sources have been shown to be extremely effective in preventing guinea worm infection. Obviously, health education highly complement the above measures.

3.1.4 Sanitary interventions help control infections other than those caused by helminths!

Improved sanitation, including disposal of human waste, creation of safe water supplies and personal and food hygiene, greatly contributes to a reduction of diseases, especially those spread through human faeces. Some of the diseases that can be reduced are those caused by viruses, bacteria or protozoa, all of which can be seen only with a microscope.

3.2 Argument: Schools are a remarkably efficient means to prevent and reduce helminth infections!

The school system in many developing countries offers an existing and comprehensive means of delivering the combination of interventions needed to achieve sustainable results. In most communities there are more schools than health centres and more teachers than nurses. This does not mean that teachers are expected to work as nurses. But teachers can play an important role as health educators and as facilitator of community actions to improve sanitary conditions. Schools are settings through which children, as well as much of the rest of the community, can be easily reached. Thus, schools provide a remarkably efficient means of reducing health problems that are caused by helminth infections.

3.3 Argument: Helminth reduction interventions can have a positive impact on children's health, learning potential and school attendance!

Studies indicate that helminth reduction programmes in schools can have a significant impact on health and learning among school children. Outcomes of deworming interventions among school children show remarkable spurts in their growth and development. In addition, evidence suggests that cognition improves concomitantly although careful long-term studies of the nature and magnitude of this effect are needed. Thus, mass treatment can reduce existing infections, and periodic use of anti-helminth treatments can prevent the development of symptomatic disease as well as improve growth, nutritional status and possibly cognitive status.

There is a positive correlation between education and production. Thus, if helminth infection inhibits educational achievement it could also eventually affect production during adulthood.

3.4 Argument: Helminth reduction interventions in schools can benefit the entire community!

Children with heavy worm infections are more likely to contaminate the environment and thus increase the risk of infection to others. When effective helminth reduction programmes are implemented in schools, they can help to reduce the spread of helminth infections within the community. Repeated treatments targeted to those



most heavily infected, e.g., pre-school and school children, have helped to lower the prevalence of soil-transmitted helminth infections in the whole community.

School health education provided to children about helminths can also serve as a means to inform families and other community members about ways to reduce helminth infections and prevent reinfections. The establishment of sanitary facilities and safe water supplies in schools is also an excellent way to demonstrate to villagers how to improve the facilities in their communities.

Once the importance and feasibility of providing helminth reduction interventions through schools become understood by citizens, school officials and policy- and decision-makers, the next step is to plan a programme. This section describes important steps that should be considered in the planning process, which include conducting a situation analysis, obtaining political and community commitments, and setting objectives for the programme.

4.1 Situation analysis

4.1.1 Purpose of conducting a situation analysis

Policy- and decision-makers will want a strong basis for their support, especially when their policies and decisions involve the allocation of resources. Accurate and up-to-date data and information can provide a basis for discussion and justification for action. Data are also essential for planning interventions that can reduce helminth infections and promote health.

4.1.2 Data items needed

It is useful to know what proportion of persons are infected with helminths and how heavily they are infected. Heavy infections are associated with disease and other problems. Death rates are also important as helminth infections may be life-threatening conditions under certain circumstances. These data are useful in determining the importance of helminth infections to health and well-being in the community. Data about rates and levels of infection, as well as deaths, may already be available from the local health unit. If they are not available, they can be obtained through a sample survey in a given area or population. Data are needed about factors that might strengthen activity, or barriers that need to be overcome. The table below shows the basic questions that need to be answered for situation analysis and the methods for collecting data.

4.
PLANNING OF
THE INTERVENTIONS



Basic Questions	Methods for Data Collection
How prevalent are helminth infections in the community?	Review of existing data; Questionnaire (Rapid assessment for urinary schistosomiasis); Sample survey by faecal or urine examinations
How prevalent are helminth infections in school-age children?	Same as above. Data for infection rate and worm burden
How frequent are the major health problems in school children caused or affected by worm infections, such as abdominal pain, diarrhoea, anaemia, bloody urine, intestinal bleeding, growth retardation and malnutrition?	Interviews with school nurses or teachers in charge; Consult school health records; Interviews with parents; Review of data available at district hospitals and local health centres
How frequent are hospital admittance and surgical emergency of school age children due to worm infection?	Review of data available at district hospitals and local health centres
Are there data on deaths due to worm infection in school age children?	Same as above
What are the important unhealthy behaviours in relation to worm infection in school children?	Observation; Questionnaire; Problem solving discussions
Do parents and children have basic knowledge on worm infection?	Questionnaire; Focal group
What are the common attitudes on infection and deworming in parents and children?	Questionnaire; Focal group
Are sanitary facilities (water supply and latrines) available and properly maintained in schools?	Survey and interview with school heads
Are there other health interventions being implemented in selected schools and is it possible to integrate them with deworming?	Interview with school and community leaders

4.2 Political/cultural acceptability

4.2.1 Political commitment

The success of efforts to reduce helminth infections through schools depends on the will, commitment, attention, support and action of health and education authorities. Experience indicates that the main constraints to such efforts are more inherent in administrative rather than technical systems. Therefore, endorsement and support from senior officials in both sectors are essential.



Increased political commitment is evidenced by:

- ◆ Designating someone with responsibility and authority to deal with issues concerned.
- ◆ Providing financial support.
- ◆ Providing technical equipment, services and materials.
- ◆ Giving clear sanction and support from the Ministries of Education and Health.
- ◆ Public acknowledgement by ministries of the importance of the problem and the feasibility to handle through schools.

4.2.2 Commitment of community

The success of efforts to reduce helminth infections also relies on the awareness and commitment of the community to want such a programme and to ensure that it is maintained within the community. The collective recognition and understanding of the problem by families and community members can help to bring about support and action for on-going efforts to influence behaviours and conditions that will reduce and prevent helminth infection.

Community commitment is strengthened/marked by

- ◆ Acknowledgement of the importance of the problem from health, education and other groups.
- ◆ Allocating local resources, e.g. public money, for deworming in school children.
- ◆ Combining the programme with other programmes in the community, such as primary health care and sanitary environment.
- ◆ Ongoing efforts to attract media attention.
- ◆ Involving existing councils, school board, organizations such as women's group to gain a critical mass of support.
- ◆ Use of both problem solving as well as health promoting approaches to improve school health.

4.2.3 Supportive school policies/practices

Development of supportive school policies and practices related to helminth reduction interventions is important to make a programme sustainable. For example, regulations for improving and maintaining adequate sanitary facilities and a safe water supply at school are essential. Also, collaboration and coordination between the health and education sectors, and between the school and the community are important requirements for success.



Examples of supportive policies and regulations

- ◆ Required periodic coordination between health and education authorities at local and district levels
- ◆ Rules about cleanliness for students and personnel, and about the proper use of latrines and water supply facilities
- ◆ Rules about keeping the school environment clean

Examples of supportive practices

- ◆ School curriculum includes helminth infection and its prevention
- ◆ Proper use of hygienic toilets/latrines
- ◆ Regular cleaning of toilets/latrines
- ◆ Existence and use of proper handwashing facilities
- ◆ Safe food and water
- ◆ Mutual daily hygienic check among students for hands and fingernails
- ◆ "Child to child", "little health inspector" programmes
- ◆ Teachers' training
- ◆ Drug supply on an ongoing basis

4.3 Goal and objectives of helminth reduction interventions in schools

4.3.1 Goal

The overall goal of any helminth reduction intervention effort should be to reduce infections and prevent re-infections to that helminth infection levels cease to be of public health importance in the community.

4.3.2 Short-term objectives

A crucial aim of short-term objectives should be to reduce helminth infections among children to levels at which harmful effects on growth and nutritional status, and the occurrence of such problems as abdominal pain and intestinal obstruction become uncommon.

- Through the first two years' effort, the proportion of children who have helminth infections is considerably reduced.
- During the same period, discomfort and school absenteeism in children due to worms become significantly less frequent.
- Helminth reduction interventions are integrated into a comprehensive approach to school health, such as the development of a "health promoting School".



4.3.3 Long-term objectives

The long-term objectives should be to maintain the school-based interventions for helminth reduction and prevention, and to expand the efforts to other schools and the community as feasible and needed to effectively control helminth infections.

- By the end of and beyond the third year, the interventions have been sustained and the project schools become core elements in expanding their experience to others.
- Certain proportion of schools in the district will have implemented helminth interventions and a network of health promoting schools established.
- These schools in the district will offer helminth interventions to members of the community.
- The attitude of the students and community members about the importance of helminths will be changed.

The school offers many opportunities to reduce helminth infections. A "Health Promoting School" strives to improve health through interventions which include health education, health services and environmental modifications. The more comprehensive approaches include, but not limited to:

- School health education
- A healthy school environment
- School health services
- School/community projects and outreach
- Health promotion for school staff
- Nutrition and food programmes
- Physical exercise, recreation and sport
- Counselling and social support.

The effectiveness of interventions integrated into each of the areas above is influenced by the extent to which the interventions are supported by school health-related policies and provided by staff who are trained. The following information describes how helminth interventions can be integrated into relevant school health programme components.

5.1 School health education

The success of helminth reduction interventions substantially depend on whether individuals are willing and able to practise behaviours that reduce the likelihood of infection. The essential goal of health education is to influence health-related behaviours and conditions by stimulating students' interest in good health and by guiding their efforts to improve their own health and that of their family.

5. INTEGRATING HELMINTH REDUCTION INTERVENTION WITHIN VARIOUS COMPONENTS OF A SCHOOL HEALTH PROGRAMME



In selecting important information to convey to students about helminths, scientific terms and details may seem to be important. However, for the purposes of health education, they are considered less important than practical and basic information that will enable students to avoid infection. For example, it is more important for a student to know how to practise hygienic behaviours than to learn the names of each parasite that lives in the water.

5.1.1 Behaviours related to helminth infections

The clear and precise delineation of behaviours specifically relevant to helminth infections in each community is essential to the development of effective school health education programmes. Important and common behaviours associated with helminth infection are listed in the box. These are not all inclusive as there may be other behaviours, specific to communities, that are not listed. Close collaboration between education and health officials is thus necessary to identify the behaviours that must be addressed to reduce helminth infections in any particular community.

Common behaviours related to helminth infections

- ◆ Unhygienic habits that allow helminth eggs to enter the mouth from the hands include:
 - Failing to wash hands before eating;
 - Failing to clean anus and wash hands after defecating;
 - Failing to wash hands after playing on the ground; and
 - Allowing dirt to remain under the fingernails;
 - Sucking on fingers.
- ◆ Behaviours that allow hookworms to penetrate the skin or enter the body include:
 - Walking or working in the field without wearing shoes or sandals;
 - Working in the field with bare hands; and
 - Ingesting unwashed raw vegetables.
- ◆ Behaviours that allow eggs or young worms to be spread back into the environment include:
 - Defecating on soil or in water with which others come in contact.
 - Urinating (in the case of urinary schistosomiasis) in water (such as a stream) with which others come in contact;
 - Using untreated or partly treated human excreta as fertilizer for crops;
 - Also, persons with guinea worm disease spread young worms if they enter water to bathe or collect the water while a guinea worm is emerging through their skin.
- ◆ Behaviours that allow young worms to enter the body with water include:
 - Swimming, bathing, fishing, washing and wading in water infected with schistosome;
 - Drinking untreated or unfiltered water in areas where guinea worm infection exists.
- ◆ Behaviours that allow worms and eggs to enter the body with food include:
 - Eating unwashed raw vegetables may lead to intestinal helminth infection and fluke infection; and
 - Eating raw or undercooked fish, shellfish and meat can result in infection with flukes and tapeworms (a group of helminths which are not described in this document).
- ◆ Behaviours that may result in continuation of infection or spread to others include:
 - Not having stool samples examined when the service is available; and
 - Failing to comply with treatment.



Knowledge, attitudes and skills related to worm transmission and reduction

Knowledge: Students and others will learn that

- There are a number of worms that can infect students and their community.
- Some worms infect persons by entering through the mouth. Others enter the body through the skin.
- Worm infections can be prevented by avoiding the practice of some very specific behaviours (listed above).
- Poor environmental sanitation is the basis for worm transmission.
- Worms in the body cause abdominal discomfort, loss of nutrients, retarded development, and even death.
- Worm infection causes school absenteeism, poor learning ability and poor performance;
- Worm infections can be easily detected and treated at a reasonably low cost;
- Re-infection can be prevented;
- The elimination of worm infection will benefit the infected individual and will also help to reduce the spread of infection to others in the community.

Attitudes: Students and others will demonstrate

- Responsibility for personal, family and community health;
- Compliance to screening and treatment in the school/community;
- Confidence to change unhealthy habits;
- Willingness to use school and community resources for information about preventing worm infection.

Skills: Students and others will be able to

- Avoid behaviours that are likely to cause infection;
- Communicate messages about worm infection to families, peers and members of the community;
- Encourage peers, siblings and family members to take part in deworming activities;
- Encourage others to change their unhealthy habits;
- Follow the regulations of maintaining a healthy school environment;
- Form a group to play a leadership role in supporting the worm reduction programme;
- Help start similar interventions in the community.

5.1.2 Knowledge, values, beliefs, skills and attitudes that influence behaviours associated with helminth infection

First and foremost, people must be taught specifically what behaviours are likely to result in helminth infection so that such behaviours can be avoided. However, other information is also needed to encourage and enable students to practise healthy behaviours. Important knowledge, attitudes and skills are listed in the box. These are not all inclusive as teachers and health workers each must identify the knowledge, values, beliefs, skills and attitudes that are most relevant to reducing helminth infection in any one community. Close collaboration between education and health officials, as well as the involvement of parents, students and community members is necessary.



5.1.3 Information needed to plan Health Education

Information about values, beliefs and attitudes that may influence behaviours and conditions associated with helminth infection can be obtained from students and parents through interviews, informal discussions or questionnaires. Knowledge of existing values, beliefs and attitudes is needed to design an effective health education strategy. Such factors can positively or negatively influence health behaviours or actions needed to change unhealthy conditions. For example, people may choose to ignore helminth infections because they have been with them for generations; local beliefs or superstitions may prevent people from accessing health services; and poorly maintained facilities like latrines may significantly influence a student's attitude about their use.

Information about values, beliefs and attitudes that may influence the behaviours and conditions associated with helminth infection, is also important to the appropriate development of educational efforts that are carried out through mass media, health workers, religious groups and other organizations.

Information about student/parent knowledge and skills, as well as local beliefs, values and attitudes enhances understanding among teachers, other school personnel and health workers. Without such information, educational interventions are not likely to be targeted to the most relevant factors that contribute to helminth infection in the community and thus are unlikely to achieve the desired results.

The following steps are important to acquire the information needed to plan health education:

- ◆ Secure the collaboration of education and health authorities and involve parents, students, community members as well as local organizations in the information collection process.
- ◆ Identify of the specific behaviours and conditions most relevant to helminth control in the community.
- ◆ Identify the specific factors associated with the behaviours and conditions that are most relevant. This involves specifically delineating the knowledge, attitudes, beliefs and skills that students need to practise healthy behaviours and avoid unhealthy ones.

5.1.4 Designing and/or selecting lessons and materials for Health Education

Educational methods (lessons, learning experiences, teaching materials, learning materials) should be designed or selected to increase knowledge, build positive attitudes and values, dispel myths, increase skills, and provide support to the reduction and prevention of helminth infections. They must focus on the knowledge, attitudes, values, beliefs and skills that contribute to spreading or reducing helminth infection in the community. Some educational interventions are better than others in influencing certain factors.

The design or selection of an education method should be based on the extent to which that method is appropriate to influence the factor which is to be influenced. For example, a lecture is an effective way to increase



knowledge, but it is less effective in influencing beliefs and building skills. Discussions, debates and carefully prepared written materials can be more effective than a lecture in dispelling the logic or foundation of local myths. Practice sessions and role play exercises can be more effective than lectures, discussions, debates and written materials in building skills.

The design or selection of an educational method should also give consideration to the targeted group. Lessons for first grade students may be too simple for parents or religious leaders. Debates and discussions may be too complex for young students but may be very effective for community leaders and the adults of the community. Since it will be important to educate beyond the classroom, a variety of educational methods will be needed.

The following steps are important in designing and selecting methods of health education:

- ◆ Design and/or select lessons and learning materials that can best influence specific factors that contribute to reducing and/or preventing helminth infections in the community. The methods selected should be ones that are most likely to influence the factor.
- ◆ Identify target groups beyond classroom, such as parents, religious group and health workers and develop or select educational methods that are consistent with their level of understanding, the setting in which they will learn and the factors that are most relevant to them in reducing and preventing helminth infection in the community.

5.1.5 Training school personnel and others to implement Health Education

The implementation of health education involves training school teachers to use a variety of educational methods. Some teachers rely on one or two educational methods, such as lectures and worksheets, to teach about academic subjects. Because health education involves influencing attitudes, values and skills, as well as knowledge to bring promote healthy behaviours and conditions, teachers must be trained to use a wide variety of teaching methods.

Health education methods that are simple, inexpensive, and culturally acceptable may be the most feasible to implement, but they will not be useful unless the methods are effective in influencing the factors that are relevant to reducing and preventing helminth infection in the community. For example, all teachers are quite familiar with the lecture method of education. Thus, the provision of relevant information to them is a simple, economical and feasible way to enable them to lecture about helminth infection. However, if attitudes and beliefs are also relevant to helminth infection in the community, lectures which contain the most important helminth information may not be enough to reduce or prevent infection.

In many communities, teachers will need training to learn to use teaching methods that are most effective in influencing a variety of factors that contribute to helminth infections in the community. Methods that en-



gage students and parents in the educational process and require their participation should be given priority, such as discussions, debates, role playing, community education projects.

Health education to reduce helminth infections can not rely on any single means of education. A variety of learning experiences are needed and teachers must be trained to use them.

The training of school personnel should involve:

- ◆ A rationale for implementing helminth reduction and prevention interventions in schools.
- ◆ Allocation of authority, personnel, time and resources to a staff member who will be responsible for initiating, managing and coordinating the training.
- ◆ Regularly scheduled follow-up sessions or other means by which to provide updates about status of helminth infections and progress in reducing and preventing helminth infection.
- ◆ The development of a core group of trainers or training teams that will enable all relevant teachers and school personnel to receive training in a timely manner.
- ◆ An evaluation to determine how confident teachers and other school personnel feel about educating to reduce and prevent helminth infections.

5.2 A healthy school environment

The school and communities' environment plays a significant role in determining whether interventions to reduce and prevent helminth infections in the school population will be effective and sustainable. Human excreta disposal, water supply and handwashing facilities are key factors that must be addressed in creating a healthy school environment.

5.2.1 General criteria for hygienic facilities and safe water supply

There are many methods that can be used to provide hygienic sanitation facilities and a safe water supply at schools. The principles and criteria involved in the selection of appropriate methods stipulate that those chosen should be:

- ◆ Technically and environmentally sound.
- ◆ Financially affordable.
- ◆ Socially and culturally acceptable.
- ◆ Reliant on labour and resources available in the community.
- ◆ Simple to install, operate and maintain.
- ◆ Easily accessible by the students.
- ◆ Related to reducing public health problems that are perceived as priorities within the community.



5.2.2 School latrines

School latrines help students and staff avoid exposure to human excreta (faeces and urine). Human excreta is the biggest source of disease-producing organisms including parasites, bacteria and viruses. Helminth eggs in faeces are spread to the soil by persons who defecate where others may be exposed to the faeces, by persons who use faecal material as fertilizer and by animals which may carry faeces or contaminated soil on their body or feet. In the case of urinary schistosomiasis eggs are spread by persons who urinate in water (e.g. canals, ponds). Therefore, it is extremely important to provide latrines for the school population to keep the school environment free from faecal pollution.

There are many types of latrines, however latrine technology and its use are culture and location specific. Various latrine systems are adopted in different parts of the world. Their differences are due to a wide variety of cultural, environmental and economic conditions. Guidelines or manuals may be available locally. The community leaders, parents, teachers and students should be involved in determining the most acceptable type of latrines. Education and health officials will need to collaborate to assure the construction of latrines that are technically appropriate as well as acceptable.

For a school latrine to function properly it must be maintained and cleaned on a daily basis. Somebody must have specific responsibility for this and compliance must be checked. Groups of school children might do the cleaning in rotation.

5.2.3 Safe water supply

A “safe water supply” is a source of water that is not contaminated by dirt, bacteria, parasites or anything else that could cause contamination.

Building a well is an example for providing safe water in many parts of the countryside. However, wells must be protected as noted in the box.

Protecting a well from contamination

- ◆ Locate wells at least 15 meters away from sources of contamination such as latrines, livestock sheds, etc.
- ◆ Build a raised wall, or a fence, around the well to keep animals away
- ◆ Place a drainage ditch around the well to prevent surface water and spilled water from contaminating the well and keep the surrounding ground dry
- ◆ Keep the water bucket clean and use a raised block on which to place water bucket to avoid contamination
- ◆ Use a well cover to prevent pollution from dust, insects and animals when not in use

There are successful practices to make water safe for drinking. For instance, simply storing water for over 24 hours and then decanting can help remove helminth eggs which fell to the bottom of the container. Boiling is a good method of killing worms/



eggs and other germs that may contaminate the water. A filtration system established with stones and sand, or gauze/filters in guinea worm areas, is another method of making water safe from worms.

Storing safe water to avoid recontamination

- ◆ Wash containers with clean water once a day or whenever they are empty
- ◆ Install a closely fitting cover on the container
- ◆ Ideally, fit a top about 5 cm above its bottom of the container
- ◆ Place the container off the floor on a box or shelf

5.2.4 Hand washing facilities

Many children become infected with helminths when faeces or dirt which contain helminth eggs get on their hands and then into their mouths. To prevent helminth infection as well as ingestion of other pathogenic organisms, it is essential to establish hand washing facilities in schools and train students to wash hands after using the latrine or playing on the ground, and before eating or handling food. There must be functioning, convenient hand-washing arrangements somewhere between the latrines and the classrooms.

5.2.5 Safe collection and disposal of waste in school

Improper disposal of rubbish is also a factor in the spread of communicable diseases. It is important that children and school personnel understand what they can do to safely dispose of waste. It will be useful to find out the common practices for disposing of waste in the community and to encourage people to follow those practices which are safe. Three ways to safely dispose of solid waste which can kill worms and eggs when the waste is contaminated with faecal materials are: composting, burning and burying.

5.3 School health services

Screening and treatment for helminth infections in schools can be an excellent entry point for the delivery of health services in schools. Helminth reduction is now more feasible than ever before owing to the discovery of safe and effective broadspectrum drugs, and the improvement and simplification of certain diagnostic procedures.

5.3.1 Screening/Diagnosis

Identification of eggs or young worms in faeces (or urine) provides evidence of helminth infection. In a school deworming programme, the objective of faecal screening is to measure the level of the proportion of students who are infected by worms and the worm load of the infected individuals to help design a deworming schedule (drugs and dosages, interval of treatments in a year) prior to intervention. For evaluation, post-



treatment faecal examination is needed. Levels of infections revealed by a baseline survey of school children can help decision-makers and planners to determine which type of interventions should be used in schools.

The screening is done by trained technicians and health workers. Schools will be responsible for:

- ◆ Explaining to the students the purpose of faecal examination and obtaining full compliance.
- ◆ Helping prepare a list of students, labels with name, ID number and class of each student to be examined and distribution to students of the labels and containers for faecal specimen.
- ◆ Providing a room with benches for the examinations if the school is far from a health centre (laboratory). This would also give an arena to show eggs/worms to the students, teachers and parents for educational benefit.
- ◆ Working with the students' parents to make sure that every student submits a specimen for examination.

Direct thin smear and **cellophane thick smear** are the techniques most commonly used for detecting helminth eggs in stool. **Urine filtration technique** is recommended for detecting eggs for urinary schistosomiasis. If workers and a microscope are available locally, limited cost is needed for the screening by using these techniques. For an experienced technician, one specimen may take a few minutes.

Helminth eggs have a characteristic shape, size, definite shell and contents inside. The "Bench Aids for the Diagnosis of Intestinal Parasites", published by WHO, provides microphotographs of helminth eggs, and detailed information on procedures of relevant laboratory techniques.

For screening urinary schistosomiasis, a rapid assessment guide containing questionnaires on blood in urine has been developed by WHO/TDR, which is easy and cheap to use and requires no laboratory equipment. The proportion of children who report blood in their urine in the past two weeks has proved to be a reliable way of identifying schools which have a high prevalence of urinary schistosomiasis and which can be targeted for early treatment.

5.3.2 Treatment

WHO (1990) recommends that treatment without prior individual screening be given to populations where surveys of school age children show that the prevalence of intestinal helminth or schistosome infections exceeds 50%. This offers significant logistic and economic advantages.

New, safe and efficient drugs to deworm children are potent tools for reducing and controlling intestinal helminth infections. Although drug treatment can achieve immediate results, the effect may not be lasting if the treatment is not repeated at appropriate intervals for a prescribed length of time and if it is not supported by sanitary measures and health education programmes. The expansion of deworming activities to pre-school children and adults will strengthen the effect of the interventions in schools.



Drug selection Important criteria in selecting a drug are: single dosage, ease of administration, limited side effects, and relatively low cost. These factors contribute to ensuring maximum efficacy and compliance. As many children may have two or three different kinds of worm infections at the same time, it will be desirable if the available drug is effective against more than one kind of helminth.

Cost The cost of the drugs for one treatment varies depending on the drug chosen, the manufacturers and the countries where the drug is purchased. Low price generic products with recognized quality are available in some developing countries. Drug treatment plays an important but not exclusive role in helminth reduction. A partnership with drug manufacturers that are capable of providing technical, material and/or financial support to an effective and sustainable effort needs to be encouraged, in addition to a favourable price for the drug.

As many infections (particularly when there are small numbers of worms present) show no symptoms, it is very important that the treatment given to children should have minimal side-effects. Neither children nor parents want to replace minor symptoms caused by infection with more apparent ones caused by medication taken to eliminate the infection.

Annex II shows the essential drugs and their dosages for treating infections of intestinal helminths, schistosome and other flukes.

School personnel and students have important roles to play in the deworming treatment process. They can:

- ◆ Obtain a parental consent for children to be treated.
- ◆ Call the students together by classes and supply water for drug-taking.
- ◆ Help nurses/health workers who are in charge of delivering tablets to monitor for possible side-effects among students, and report any discomfort which may or may not be relevant to the treatment.

Technical points of drug treatment

Side-effects Side effects with these drugs are mild and transient. Abdominal discomfort and skin rashes have rarely been reported.

Joint drug delivery Concurrent administration of albendazole and praziquantel has been shown to be safe, which may be considered in areas where both schistosomiasis and intestinal helminth infections are prevalent.

Efficacy refers to how well a drug work in eliminating infections. The term "cure rate" is used to assess drug efficacy, which refers to the proportion of persons with no eggs found in faeces after treatment.

Frequency The frequency of treatment depends on the goal of the project and local conditions. For intestinal helminth infection, no less than two treatments a year are recommended.

5.3.3 Experience from past programmes

Japan has been successful in helminth control in its entire population since the end of World War II by starting with deworming programmes in school children. Following the Japanese experience, the Republic of Korea launched a deworming campaign in 1969 which was primarily directed



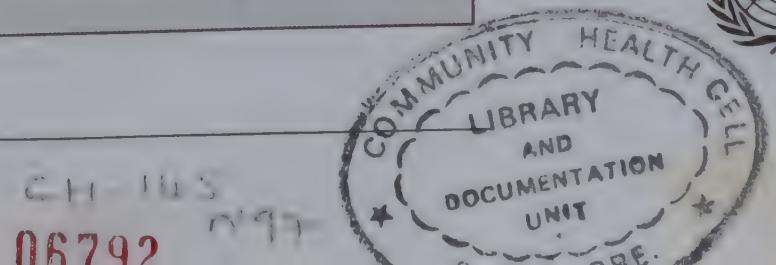
at school children. As a result of the campaign, and also of the significant improvement of environmental sanitation, the prevalence of roundworm infection in students decreased from 55.4% in 1969 to 0.07% in 1992, and similarly in the whole population. The major factors which influenced the success of these programmes are the commitment of health and education authorities to sustain the programmes over time, social involvement of parents and community members, and supplemental long term programme support from nongovernmental agencies and academic groups. Similar experience was also reported in some other countries of Africa and South America.

5.4 School/community projects and outreach

The success of efforts to improve sanitation, reduce communicable diseases, improve personal hygiene, child development and human nutrition, is intimately linked to communal as well as individual behaviours and decisions. It is therefore increasingly recognized that the school and community must work together to support health. School/community projects provide a way for students to become actively involved in learning about how to reduce helminth infection. Community participants in the projects can acquire specific health-related knowledge as well as skills needed to take community actions that will result in sustainable helminth reduction. Helminth reduction activities provide excellent opportunities to undertake school/community projects that can affect the health status of the entire community.

The deworming process can be an educational experience which can be used to stimulate community participation. The result of deworming is immediate and visible and thus easily understood by both students and parents. The passing of adult worms by treatment can provide evidence of effectiveness that will help win community enthusiasm and support. A feeling of appreciation and trust towards service providers will lead to an enhancement of teachers and parents' credibility. Furthermore, when deworming is accompanied by relevant health education, the impact will be strengthened, showing the community how - by their own efforts - they can improve their school and village and the welfare of their families. Some examples of school/community activities are described below.

- ◆ Children are encouraged to talk to their mothers and community members about worms, especially when they feel better after the programme, and to invite them to the school's deworming programme.
- ◆ Child-to-child approaches have been effective in bringing health messages to children, either in schools or in their community. When pupils understand the benefits of deworming they often bring their siblings for examination and treatment.
- ◆ Mothers who predominate in the role of "health educator" and child care within household can make a significant contribution to improving the level of understanding on helminth reduction and prevention within the household and then the community.
- ◆ Demonstration of worms or eggs under a microscope is a convincing way to stimulate the students and community members for active support and participation.
- ◆ Approaches are needed to ensure that deworming programme in schools are also available to school age children who are not attending schools and to pre-school children who are often heavily infected and responsible for contaminating the environment through their defecation habits.
- ◆ Outreach can be most successful when there is cooperation and coordination between the school health programme and the local health centres.



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5.5 Health promotion for school staff

A school health programme should not be limited to improving the health of children enrolled in school. The protection and improvement of the health of its employees - teachers, administrators and supporting staff - should also be emphasized. As school personnel in most countries, particularly in developing ones, have had little or no health education preparation, strategies to promote their health should form part of all pre- and in-service training.

Teacher training is an important prerequisite for providing health education to students. In addition, teachers traditionally have an influential role to play in their communities.

Teachers need to know:

- ◆ How to avoid helminth infection themselves.
- ◆ Behaviours and conditions in the community that affect helminth infection.
- ◆ Knowledge, attitudes, values, beliefs and skills of children/parents and community members that affect behaviours and conditions.
- ◆ Specific teaching materials to influence knowledge, attitudes, values, beliefs and skills that affect behaviours and conditions.
- ◆ How to explain the importance of helminth reduction to students and communities.
- ◆ What to do in helping plan and organize deworming activities, and obtain compliance from students.

Helminth infections can also be an important problem among staff, especially in rural schools. Improvements in their health-related knowledge, attitudes and behaviours through health promotion activities can help improve helminth interventions and other school health programmes.

5.6 Nutrition and food safety

The interactions of nutrition and infection have been generally recognized: individuals become debilitated as a result of malnutrition and are susceptible to infections and, conversely, certain infections have a profound influence on nutritional status. The "malnutrition-infection" complex remains the most prevalent public health problem in the world today, especially in children.

5.6.1 Helminth infection and malnutrition

Intestinal helminth infection may be associated with a reduction in food intake due to discomfort, poor appetite, and malabsorption, and may lead to malnutrition. As indicated by studies, roundworm infection may influence the utilization of fat, protein and vitamin A precursors, and hookworm disease can result in anaemia as well as iron and protein deficiency. Recently it has been shown three times yearly deworming can prevent the loss of quarter of a litre of blood per child every year. Regular anthelmintic treatment is an extremely cost effective way of improving the general health status of the school children. The schools should be aware



that the two conditions frequently co-exist in school children and a successful deworming programme can improve the nutritional status of children.

WHO recommends that in areas where the prevalence of mild-moderate underweight in children is greater than 25%, and where parasites are known to be widespread, high priority should be given to deworming programmes.

5.6.2 Micronutrient supplementation (iron, iodine and vitamin A)

Iron deficient school-age children tend to exhibit reduced levels of alertness, attention and concentration, and display lower levels of overall intellectual performance than those without the deficiency. The consequences of iodine deficiency disorder (IDD), though not related to parasitic infections, are also significant in terms of learning results among primary school students. Vitamin A deficiency may be associated with increased prevalence of infection and influence school attendance of the children.

A micronutrient supplementation programme is proposed to be integrated into deworming programmes. This involves:

- ◆ **Iodine** supplementation through iodized salt which is available in many countries.
- ◆ **Vitamin A** supplementation using capsules at low cost.
- ◆ **Iron** tablets for those with iron-deficiency anaemia.
- ◆ **Nutrition education** which provides food-based interventions for the micronutrient deficiencies. For instance, students should be encouraged to take vitamin A rich food such as carrot which may not be customarily a part of the local diet.

5.6.3 Prevention of foodborne parasitic infections

Humans can be infected by dozens of parasitic helminths through ingesting uncooked or inadequately cooked meat, fish or other animal food and vegetables. School children are often the victims of foodborne parasitic infections and other illnesses from foods prepared in their homes, in the school canteens, or bought from street food vendors. Diarrhoea and abdominal discomfort caused by unsafe food increase school absenteeism while impairing children's health.



Food safety through schools

- ◆ Educating students with knowledge and practices of preventing food-borne helminth infections.
- ◆ Establishing rules in school feeding programme, i.e.:
 - Cook food (meat, fish, etc.) thoroughly;
 - Do not eat raw fish, meat or vegetables known to be possibly infected/contaminated by worms;
 - Wash vegetables thoroughly when they are taken raw;
 - Avoid contact between raw foods and cooked foods;
 - Wash hands carefully...
- ◆ Providing handwashing facilities and enough water for students as well as school canteen workers.
- ◆ Training food handlers for safe processing and supply in school canteen.
- ◆ Encouraging students to communicate food safety message to parents and other children.

6.**EVALUATION****6.1 Evaluation throughout the project**

An objective evaluation of the implementation and accomplishments of deworming and behavioral modification should be scheduled at the beginning, middle and end of the programme cycle. The evaluation component should include a needs assessment, baseline data collection including biomedical and behavioral indicators, monitoring procedures, and periodic and final assessments.

Evaluation is important because it helps:

- ◆ **Plan the project** by providing information to policy-makers, sponsors, planners, administrators and participants;
- ◆ **Make improvements or adjustments** in the process of implementation;
- ◆ **Provide feedback** to those involved in project planning to determine which parts of the project are working well and which are not;
- ◆ Schools and communities to **value the effort**;
- ◆ **Document experience** gained from the project so that it can be shared with others.

6.2 Type of evaluation

Process and impact evaluations provide information that can be invaluable in reshaping and revising programme development. The process evaluation assesses how well the programme is being implemented and the impact evaluation measures the impact of the programme on the target population.

Quite often, the evaluation component is neglected because resources, including time, personnel and budget, are scarce. Evaluation of the extent to which the planned interventions are being implemented as intended may be more feasible in countries with limited resources than evaluation to measure the impact of interventions on health



and behaviour. The measurement of the impact on students' health status can be costly and complex. Countries with limited resources might invest in process evaluation to ensure that their intended programme is effectively implemented before attempting impact evaluation.

6.3 What to evaluate

Evaluation may be addressed to various aspects of the programme including goals and objectives, implementation, effect on participants, and cost-effectiveness. Practically, however, the basic items listed in the table below should be measured in all programmes.

Basic Items	Method of measurement
Proportion of targeted school children who received drug treatment	Record review
Extent of reduction of prevalence/ worm burden of helminth infection	Biomedical screening
Any specific side-effect which may frustrate the process of mass treatment	Record review; Interview with health workers and school heads
Extent to which children improved knowledge on worms	Questionnaire; Focal group discussion
Extent of changes on children's behaviours, attitudes and skills related to helminth infections	Questionnaire; Focal group discussion; Interview with parents and teachers; Observations
Extent to which parents are satisfied with their children dewormed	Questionnaire; Interview
Physical installations - availability of water and its quality and quantity, latrines/toilets and their use and maintenance, handwashing facilities and functioning	Observations; Interview with students and teachers; Focal group discussion
Affordability of the programme for families and community	Cost analysis; Interview with parents and community leaders
How well the school health components are addressed in helminth reduction efforts	Focal group discussion; Interview with school health officers and school heads
Extent of programme expansion to other schools in the district	Interview with programme coordinator and school health officers
Extent of improvement of intersectoral cooperation, especially between health and education	Interview with programme coordinator and school health officers



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ANNEX I

IMPORTANT
HELMINTHS IN
SCHOOL CHILDREN

Common Name	Scientific Name	Location of Parasitism	Geographical Distribution
Roundworm	<u>Ascaris lumbricoides</u>	Intestine	Global
Whipworm	<u>Trichuris trichiura</u>	Intestine	Global
Hookworm	<u>Ancylostoma duodenale</u> <u>Necator americanus</u>	Intestine	Global
Schistosome (blood fluke)	<u>Schistosoma mansoni</u> <u>Schistosoma japonicum</u> <u>Schistosoma mekongi</u> <u>Schistosoma haematobium</u>	Blood vessels of intestine Blood vessels of intestine Blood vessels of urinary bladder	Africa South America Middle East Asia Africa Middle East
Liver fluke	<u>Fasciola hepatica</u> <u>Clonorchis sinensis</u> <u>Opisthorchis viverrini</u> <u>Opisthorchis felineus</u>	Liver	Global Asia Asia Asia, Europe
Lung fluke	<u>Paragonimus westermani</u> and others	Lungs, brain, skin	Asia, Africa Americas
Intestinal fluke	<u>Fasciolopsis buski</u> <u>Echinostoma</u> sp <u>Heterophyes</u> sp. and others	Intestine	Global
Guinea worm	<u>Dracunculus medinensis</u>	Skin	Africa South and West Asia



	Roundworm	Whipworm	Hookworm	Schisto-some	Intestinal Flukes	Liver and Lung Flukes ³
Albendazole ¹ (400 mg)	++++	++	++	++		
Levamisole ¹ (2.5 mg/kg ²)	++++	++	++			
Mebendazole ¹ (500 mg)	++++	++	++			
Pyrantel ¹ (10 mg/kg)	++++		++			
Praziquantel ¹ (40 mg/kg)				++++		
Praziquantel ¹ (25 mg/kg)					++++	
Praziquantel (up to 150 mg/kg in 2 days)						++++

1 In single dose

2 Kilogram body weight

3 Excluding *Fasciola*

4 The usual dose of mebendazole is 100 mg, twice daily, for 3 days. A single dose of 500 mg seems less effective.

++++ Highly effective

+++ Effective

++ Effective in mild to moderate infections

ANNEX 2

**DOSAGE AND
ESTIMATED
EFFECTIVENESS OF
DRUGS IN
CURRENT USE FOR
HELMINTH
INFECTIONS**

(Based on: WHO 1990
- Drugs Used in
Parasitic Diseases)



